JUSTDIGGIT

Rehamna landscape restoration project

I. Introduction

Restoring degraded land and better preserving rainwater is fundamental to create a green and livable planet for all. With the current pace of our economies, we consume 1.5-2 times more than our natural resources on earth can handle, resulting in rapid desertification, water shortages, food insecurity and changes in social and economic dynamics. We face rising global temperatures which impact especially the semi-arid regions in the world like Morocco, with changing rain patterns and periods of flooding and droughts. According to the UNCCD, we can restore 20 million km^2 of degraded land on our planet. We believe we can turn things around and work on a green and livable planet together. That is why we offer a simple solution worth fighting for. Our focus is on the African continent, where people are most affected and the potential to restore ecosystems is phenomenal.

It is time for action. We owe it primarily to ourselves. Healthy economies require healthy ecosystems. With the COP 22 as a platform for international and Pan-African dialogue about climate adaptation solutions, we offer a tangible approach to combat desertification and revive local communities in their habitat.

With 62% of rainwater unused in the region of Marrakesh, rainwater harvesting, combined with reforestation, sustainable agriculture and soil improvement are great opportunities to kick start the habitat of semi-arid regions in the Kingdom.

Several regional and national programs for climate adaptation are already planned and in execution in Marrakesh region, making our project an ideal accelerator to bring together multiple techniques, partners and funding options to make the maximum impact by 2020.

2. Objectives

We want to stimulate climate adaptation solutions via landscape restoration which will provide a green, livable habitat for the communities most affected by climate change and land degradation.

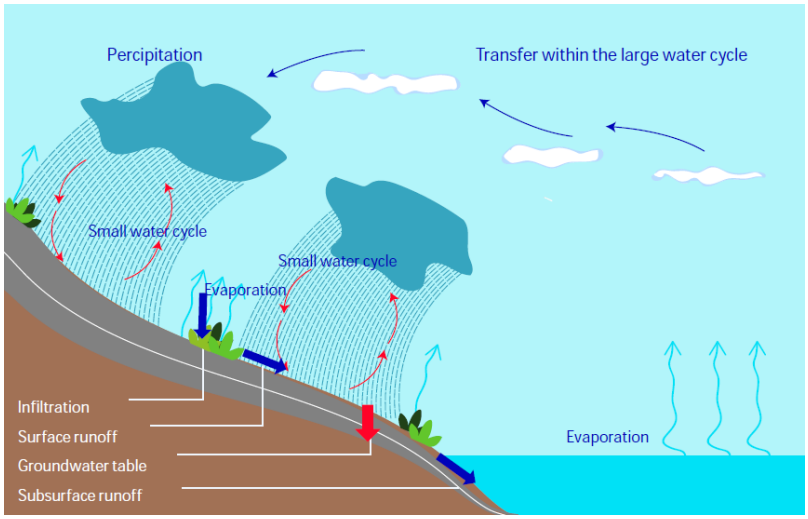
Our objectives are:

- Combat and mitigate climate change through large scale re-greening of degraded land, using rainwater harvesting, reforestation and sustainable agriculture.
- Improve livelihoods of millions of people by bringing back biodiversity and vegetation in semi-arid environments as a foundation for prosperity.
- Create a global green movement for positive climate action.
- Co-develop innovative finance solutions to build continuity of our ecosystem services through economic valuation.

3. Hydrologic Corridor

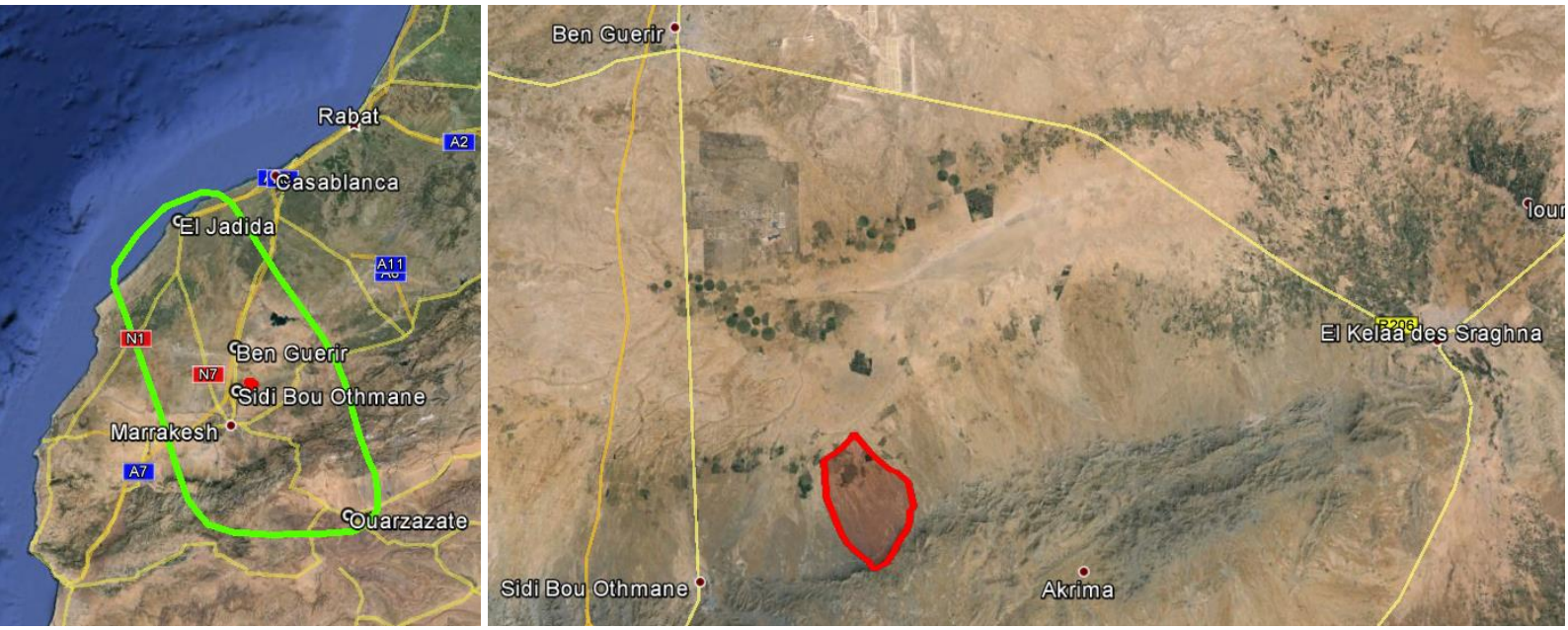
Our first strategic focus is to develop, co-fund and manage large scale landscape restoration projects around the world to build resiliency against climate change. We restore soil and vegetation, utilizing rainwater harvesting, reforestation and sustainable land use practices.

At our scale, once vegetation comes back, it starts to evaporate moisture, create atmospheric cooling, clouds and local rains. This is called the small water cycle. When these small water cycles interact with incoming clouds from the oceans, extreme weather is tempered and rain more evenly distributed. Through this system approach we rehabilitate the small water cycles on strategic locations. These locations are chosen with the help of climate models to predict the best way to form a Hydrologic Corridor that impacts the regional climate and creates more and evenly distributed rain.



The hydrological cycles

In summary, we kick-start Mother Nature and impact the regional climate over thousands of square kilometres for each Hydrologic Corridor.



The Hydrologic Corridor Morocco (left) and location of the demonstration project in Rehamna (right)

Methodology

Restoration of ecological systems starts with water. Most degraded regions still receive enough rainfall to restore the original ecosystem – but the rains are so concentrated that the bare and hard soil does not retaining enough water causing excess runoff, erosion and flooding.

Water and fertile soil flowing away unutilized

Using ancient and proven intervention methods, this water can be captured for later use. This water breaks the ecosystem's cycle of decay through improved soil conditions and the return of vegetation – which lead to more crops, grazing lands, fodder, shadow, biodiversity and an even further increased water retention capacity. It is as simple as that.

There are many of these water harvesting techniques available on different scales, such as contour buns, terraces, trenches and dams. Other helpful soil moisture interventions include, permaculture,

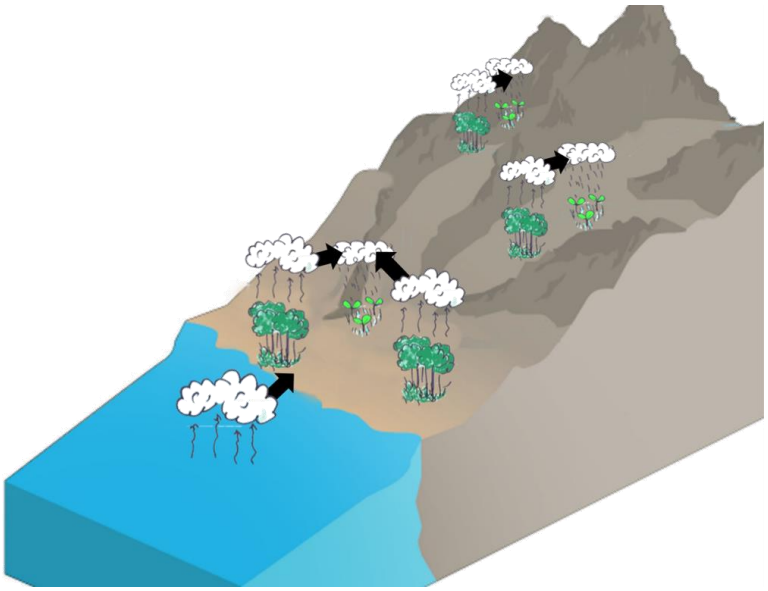
agroforestry, temporary fencing to prevent over grazing, re-planting, re-seeding and soil and water conservation. All these techniques increase soil moisture and plant growth. Depending on local conditions (gradient, soil type, amount of rainfall, etc.) and culture (farmers or pastoralist) we select the most suitable techniques with the input from local communities.

The impact of landscape restoration

As the ecosystem restores it impacts the local climate and benefits the livelihoods of local communities. Studies have shown this creates opportunities for improved employment, health and education.

Besides direct and local benefits from the techniques listed above, halting the process of desertification in specific regions also has more large-scale and long-term effects. Local climate impacts and resulting clouds are transported to adjacent regions where they increase precipitation and have a cooling effect. If carried out on a large enough scale worldwide, landscape restoration mitigates climate change. As Justdiggit, this is our ultimate objective!

The scientific background behind the hydrologic corridor concept is described in Justdiggit's white paper, which can be downloaded here: http://justdiggit.org/wp-content/uploads/2015/08/Naga-scientific-whitepaper.pdf



Concept of the hydrologic corridor

4. Approach

First project = Demonstration project

We'll start with a demonstration project to show that using relatively simple interventions degraded land can be re-greened. This demonstration project will be a full scale (3,000 ha) project that will also act as the first project of the full Hydrologic Corridor Morocco.

In the demonstration project different types of interventions in different landscapes zones (hills, valley, etc.) will be applied. This way we can compare and optimise the interventions, develop and try out business cases and demonstrate that re-greening is possible on a large scale in different environments.

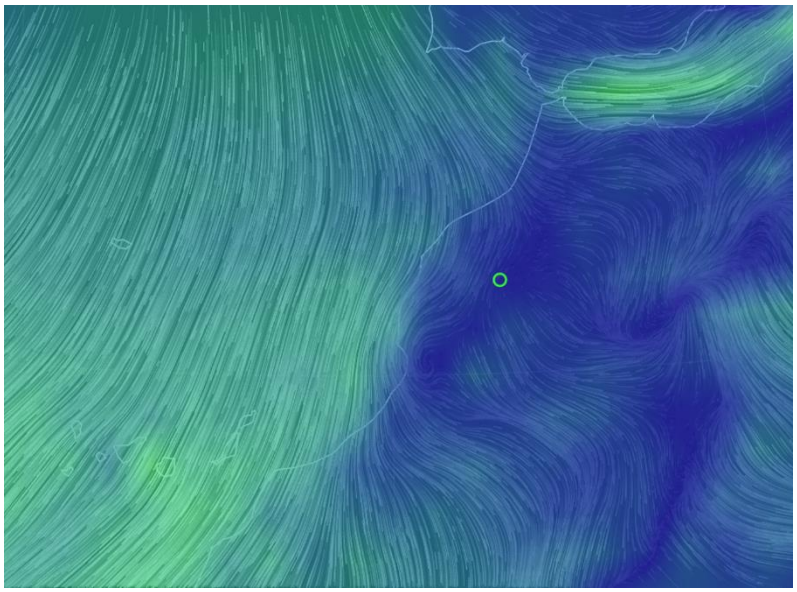
The impacts of the demonstration project will also be used in the awareness campaigns and the project site is ideal to generate enthusiasm about landscape restoration potential for visitors ranging from farmers to international delegates.

Science and monitoring

All along the Hydrologic Corridor project we will embrace scientific partners to:

- Determine the optimal locations for the project areas and interventions (based on GIS data analysis, climate models and field knowledge).
- Monitor and evaluate the impact of the interventions on the ground (vegetation, environmental, socio-economics, water, etc.).
- Monitor the effects of the Hydrological Corridor on the climate (temperature, humidity, rainfall).

Wageningen University is one of the top-ranked environmental and agricultural universities in the world and is part of the JustDiggit consortium. For the Hydrological Corridor Morocco we will work together with Cady Ayyad University, University Mohammed VI Polytechnique Ben Guerir and other Moroccan institutes to carry out research, monitor and evaluate the impact of the projects.



Analysis of wind direction in Morocco

Scaling to a full Hydrologic Corridor Morocco

Based on the experiences gained from the demonstration project, backed by the scientific partners the full Hydrologic Corridor Morocco will be planned and implemented. In total about 15 project

areas of 3,000 hectares each will be re-greened. The combined effect will create a hydrologic corridor from El Jadida to Marrakesh and into the Atlas towards Ouarzazate. It will impact the regional climate and be an international project for landscape restoration that can inspire other countries to do the same.

5. Demonstration project Rehamna

Location

We choose the Province of Rehamna as the location for the demonstration project of the Hydrologic Corridor. It's very well suited based on:

- **Physical conditions**: suitable soil types, gradient of the land, vegetation types and land use.
- **Climatic conditions**: winds blowing towards the Atlas Mountains bringing in moisture from the ocean.
- **Degradation** status: the area has degraded over the past decades, but there is still more than enough potential for restoration.
- **Social**: government and inhabitants are very willing to cooperate and several projects have already been implemented where we can build upon.

The demonstration project is located between Marrakech and Ben Guerir about 10 km East of Sidi Bou Othmane. The project area is 3,000 ha (30 km^2) and ranges from the northern flanks of the Jebilet mountains down to the Sidi Bou Othmane – El Kelaa des Sraghna road. Currently we are defining the exact boundaries of the project area based on field surveys.

Goals

The goals of the demonstration project are to increase vegetation cover by:

- Reducing erosion (less fertile soil is lost).
- Reducing runoff (less flooding).
- Increasing infiltration (more soil moisture and groundwater).
- Reducing overgrazing.
- Increasing soil fertility.

Restoring degraded lands and bringing back vegetation leads to the following benefits:

On the ground	Climatic
Increase crop yields	Temperature
Improved water availability	Humidity
Employment	Rainfall
Biodiversity & nature	
Less erosion	
Less flooding	

6. What we are going to do

Within the project we introduce different proven restoration techniques and where possible integrate them in existing projects and best practices. This diversity creates resilience. We have divided the area into 3 different zones. Each of these zones has their own set of interventions described below.

Zone I Hills

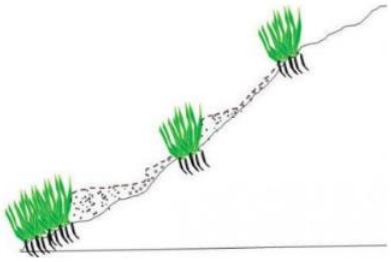
Current land use: Sparse trees, afforestation-reforestation projects, grazing land, gully and rill erosion

What **Assisted afforestation**

How Tree planting assisted by elements de banquettes (type of terraces made of earth bunds). Increase water availability for trees, reduce erosion. Compost, biochar and mulching can be combined to assist tree growth.

What **Living barriers**

How Rock lines, vegetated barriers. Create barriers from loose rocks to down the water, increase infiltration, capture fertile soil and seeds, plants are (e.g. cactus) planted for stability. Fruits from plants can be harvested.



What **(Agro-)Silvo-pastoral systems**

How Combined agroforestry and controlled grazing. Regeneration and planting, enclosures, controlled grazing. Regeneration of natural understorey and grassland vegetation combined with tree and shrub planting.
Enclosures until saplings high enough and vegetation restored. Controlled grazing with shifting paddocks

Zone 2 Footslopes

Current land use: Sparse trees, rainfed cereal production, grazing

What **Agroforestry**

How Tree planting combined with rain fed crops. Rotation cereal and legume. Mixtures of different cultivars of wheat /barley to reduce risks, increase biodiversity above and below ground, reduce pest and diseases. Microbasins around trees. Mulching to reduce evaporation. Biochar (activated) to host microorganisms, increase CEC, hold moisture, stocks carbon.

What **Living barriers**

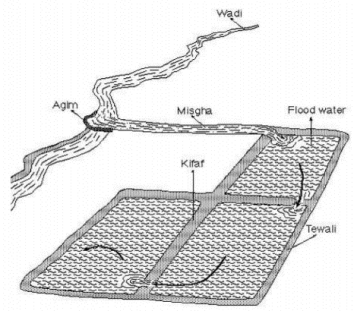
How Rock lines, vegetated barriers. Remove rocks from cropland to increase productivity of cropland. Rocks can be placed along contours to intercept runoff.

What **Yeomans plough or Vallerani plough**

How Subsoil ploughs to increase infiltration and soil aeration to enhance microbiology, soil structuring and water retention.

What **Spate irrigation/meskat**

How Collect water from gullies to use for irrigation.



Zone 3 Irrigated agriculture

Current land use: Irrigated agriculture (olive, citrus, onions, etc.)

What **Irrigated agro-forestry system**

How Combinations of trees + fodder crops/vegetables/herbes. Different rooting systems, different canopies, different cycles, synergies > nitrogen fixing crops, nutrient upconing/cycling, pest control. Soil is covered and reduces evaporation keeps moisture. Integration of animals. Weed and insect suppression. Fertilisation, important for flowering. Manure important for physical, biological, and chemical soil properties. Intercropping legume + cereal saves up to 14% water.

What **System of Water for Agriculture Rejuvenation (SWAR)**

How Improved irrigation for trees: saves 50% water compared to drip.

7. Expected results

Our landscape restoration projects have the following impact measurements:

- Increase the percentage of vegetation cover.
- Increase the percentage of rainwater infiltration (reduction of runoff).
- Increase the amount of carbon (CO_2) sequestration.
- Reduce the amount of water needed for irrigation
- Impact the local climate (temperature).
- Social and economic impact: local job creation, local social cohesion.